

Relationship between Chest CT Scan Findings and Clinicians' Expectations in Diagnosis and Prognosis of Respiratory Disease Patients at a Tertiary Care Hospital: A Retrospective Observational Study

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ABSTRACT

Introduction: The use of chest Computed Tomography (CT) scans has significantly increased in recent times, and it is also considered the preferred investigation method in various cases, including occult pneumothorax and interstitial lung diseases.

Aim: To assess the relationship between chest CT scan findings/outcomes, clinicians' expectations, and their influence on treatment outcomes.

Materials and Methods: The present retrospective analytical observational study was conducted in the Department of Radiodiagnosis and Respiratory Medicine at a tertiary-level hospital, Adesh Medical College and Hospital, Kurukshetra, Haryana, India. The findings of the selected chest CT scans were classified as normal, incidental, or pathological. The response of the consulting physicians to these scans was divided into three grades: highly expected, moderately expected, and unexpected. The impact of these scans on patients' treatment was divided into three categories: major, minor, and none. The collected data were analysed using the Statistical Package for Social Sciences (SPSS) version 28.0, and the Chi-square

test was used to assess the association between different variables.

Results: The mean age of study participants was approximately 58±15 years. Out of the total 74 scans (each belonging to a different individual), the findings of the chest CT scans revealed that 59 (79.7%) scans were pathological, 11 (14.9%) were incidental, and only 4 (5.4%) were normal. The outcomes of these scans were highly expected in 42 (56.7%) cases, moderately expected in 25 (33.8%), and unexpected in 7 (9.5%). These scans had a major impact on the patient's treatment course in 28 (37.8%) cases, minor impact in 40 (54%), and no influence in 6 (8.1%) cases. The Chi-square test showed a significant association between chest CT scan outcomes and clinicians' expectations, chest CT scan outcomes and their influence on treatment, as well as clinicians' expectations and the effect of scans on treatment. The p-value <0.05 was considered statistically significant for all three cases.

Conclusion: Chest CT scans significantly impact the diagnostic and treatment pathway for patients.

Keywords: Computed tomography, Clinical impact, Lung pathology, Radiology

INTRODUCTION

Since its introduction in medical practice in 1972 [1], the use of Computed Tomography (CT) scans has exponentially increased worldwide [2]. In the present day, chest CT plays a vital role in diagnosing various lung pathologies, particularly during the Coronavirus Disease-19 (COVID-19) pandemic [3].

Chest X-ray is the first and most commonly performed radiologic imaging technique for suspected pulmonary pathologies [4]. However, CT scans are considered the modality of choice, especially in cases like occult pneumothorax and interstitial lung diseases [5]. CT scans also serve as the gold standard investigation for diagnosing pulmonary embolism [6]. Nowadays, High-Resolution CT (HR-CT) is employed to assess the lung's architecture, and when compared to conventional whole-volume helical CT scans, HR-CT delivers significantly lower radiation doses, up to 90% less [7].

In a study by Bortoluzzi CF et al., it was demonstrated that the use of chest CT scans during routine biennial follow-ups significantly influenced the clinical management of cystic fibrosis. This impact was observed in terms of diagnosis, treatment course, and the need for hospitalisation, highlighting the clinical impact of chest CT scans in pulmonary pathologies [8].

However, despite the aforementioned benefits, establishing a relationship between radiologic outcomes and clinical consequences

is essential to determine the success of a radiological investigation in clinical practice. The efficiency of diagnosing the underlying clinical condition and its impact on the treatment course determine the indispensability of a radiological imaging technique. No research study was found that acknowledges this correlation encompassing multiple pulmonary pathologies. Therefore, the present study attempted to analyse and categorise chest CT scans based on their radiological findings, assess the relationship between the chest CT scan findings/outcome and the clinician's expectations, and examine the relationship between CT scan results and their influence on treatment.

MATERIALS AND METHODS

A retrospective analytical observational study was conducted at the Department of Radiodiagnosis and Respiratory Medicine of Adesh Medical College and Hospital, Kurukshetra, Haryana, India, during a one-year period from November 1, 2021, to October 31, 2022. It was initiated after obtaining requisite permission from the Institutional Research Committee (IRC) and Institutional Ethics Committee (IEC).

Inclusion and Exclusion criteria: All In Patient Department (IPD) patients aged 16 years or older who underwent a chest CT scan, regardless of aetiology, diagnosis, or prognosis, were included. Out

Patient Department (OPD) patients and patients with incomplete medical records were excluded.

Study Procedure

The radiological data was obtained from the Department of Radiodiagnosis, while the corresponding medical records were retrieved from the Department of Respiratory Medicine of the hospital, based on the aforementioned inclusion and exclusion criteria. The classification of chest CT scans was done through a consensus discussion among all the authors, and in case of any difference of opinion, the head of the Department of Radiodiagnosis was consulted for the final verdict. The findings of the chest CT scans were categorised as normal, incidental, or pathological:

- Normal findings were defined as those without any incidental and/or pathological findings.
- The term "incidental findings" was used for CT scans that showed deviations from normal but did not require any medical intervention (e.g., mild Chronic Obstructive Pulmonary Disease (COPD), minor aortic calcification, minor pleural calcification, etc.).
- Lastly, pathological findings were those that required medical and/or surgical treatment, such as pneumothorax, infiltrates, flail chest, etc.

The response or evaluation of the consulting physicians regarding these CT scans was divided into three grades: highly expected, moderately expected, and unexpected results:

- Highly expected results were those in which the investigation confirmed the exact diagnosis suspected by the clinician.
- CT scans that showed a pathology with a low suspicion or showed a pathology from the list of differential diagnoses but was not the directly suspected condition were classified as moderately suspected results.
- Unexpected results were those that yielded results contrary to the clinically suspected diagnosis.

Finally, the impact of a chest CT scan on the patient's treatment was divided into three categories- major, minor, and none:

- Major impact implied that the scan either initiated or altered the treatment.
- Cases where a CT scan merely confirmed the diagnosis and incurred no alteration to the treatment were categorised as having a minor impact.
- No impact was used to represent cases where the investigation neither influenced the diagnosis nor the treatment.

STATISTICAL ANALYSIS

The data collected was entered into a Microsoft excel worksheet and analysed using SPSS version 28.0. The descriptive statistics were summarised using the median and range. The Chi-squared test was used to assess the association between different variables. A p-value <0.05 was considered statistically significant.

RESULTS

Out of the total chest CT scans requested by the Respiratory Medicine Department for its IPD patients, 74 scans (each belonging to a different individual) were chosen for the study after screening through the aforementioned inclusion and exclusion criteria. Among these 74 patients' scans, 52 (70.3%) were male, and 22 (29.7) were female. The mean age of study participants was approximately 58±15 years [Table/Fig-1].

The findings of these chest CT scans were pathological in 79.7% (n=59) scans, incidental in only 14.9% (n=11) scans, and only 5.4% (n=4) scans were reported as normal. Irrespective of the report, 56.7% (n=42) of scans were highly expected as per the requesting doctors' assessment of the patient. Approximately two-thirds

Category	Number (n)	
Gender	Male	52
	Female	22
Age group	16-20 years	01
	21-40 years	11
	41-60 years	29
	>60 years	33
Smoking status	Smoker	32
	Non smoker	42

[Table/Fig-1]: Socio-demographic distribution of data.

(67.8%) of scans with pathological outcomes were highly expected by the physician [Table/Fig-2]. The data was highly significant as the p-value was <0.001.

Result	Highly expected	Moderately expected	Unexpected	Total
Normal	1 (1.35%)	1 (1.35%)	2 (2.70%)	4 (5.41%)
Incidental	1 (1.35%)	6 (8.11%)	4 (5.41%)	11 (14.87%)
Pathological	40 (54.05%)	18 (24.33%)	1 (1.35%)	59 (79.72%)
Total	42 (56.75%)	25 (33.79%)	7 (9.46%)	74

[Table/Fig-2]: Association between chest CT scan outcomes and clinician's expectations using Chi-square test (p-value <0.001).

The outcome of the scans had a major impact on the patient's course of treatment in 28 (37.8%) cases, a minor influence in 40 (54.05%), and no influence in 6 (8.1%) of them. There wasn't even a single pathological outcome that did not influence the treatment plan of the patient in any way. All of them either resulted in a major influence (45.8%, n=27) or a minor influence (54.2%, n=32). On the other hand, normal scans had no impact on the alteration of the treatment plan [Table/Fig-3]. This data was significant because the p-value was 0.0033.

Result	Major	Minor	No influence	Total
Normal	0	1 (1.35%)	3 (4.05%)	4 (5.41%)
Incidental	1 (1.35%)	7 (9.46%)	3 (4.05%)	11 (14.87%)
Pathological	27 (36.49%)	32 (43.25%)	0	59 (79.72%)
Total	28 (37.84%)	40 (54.05%)	6 (8.10%)	74

[Table/Fig-3]: Association between chest CT scan outcomes and their influence on treatment using Chi-square test (p-value=0.0033).

While the majority of highly expected outcomes (69%, n=29) caused a minor change to the treatment protocol, an almost similar number of CT scans with moderately expected outcomes caused both major (52%, n=13) and minor (44%, n=11) impacts on the treatment of the patient. Among the scans categorised as 'Unexpected' based on their findings, none caused a minor influence on the treatment plan. While most led to a major change (71.4%, n=5), a small number of cases (28.6%, n=2) had no influence at all [Table/Fig-4]. The p-value came out to be <0.001, thus the data was highly significant.

Result	Major	Minor	No influence	Total
Highly expected	10 (13.51%)	29 (39.19%)	3 (4.05%)	42 (56.75%)
Moderately expected	13 (17.57%)	11 (14.87%)	1 (1.35%)	25 (33.79%)
Unexpected	5 (6.76%)	0	2 (2.70%)	7 (9.46%)
Total	28 (37.84%)	40 (54.06%)	6 (8.10%)	74

[Table/Fig-4]: Association between clinician's expectations from chest CT scans and the influence of these scans on patients' treatment using Chi-square test (p-value <0.001).

DISCUSSION

Through the current study, the authors aimed to analyse the impact of a chest CT scan on clinical diagnosis and its influence on the

patient's treatment plan. Despite being retrospective, the study faced no hindrance as detailed patient care notes were available, which adequately fulfilled the research objectives, as observed in a previous radiological study [9]. The clinicians considered multiple factors when assessing the chest CT scans and categorising them as highly expected or moderately expected. These factors included the patient's medical history, clinical signs and symptoms, clinical examination, and any available preliminary investigations.

Clinically, the present study has helped authors to assess the importance of a chest CT scan as a radiographic modality in assisting physicians in diagnosing patients with respiratory illnesses and determining their overall prognosis. Considering this, along with other factors like cost and availability, it can aid healthcare professionals in deciding the most appropriate investigative approach for their patients. Since the present study was a novel study, there was limited data available regarding chest CT scans in a similar context to support or refute authors' findings. Thus, the present study also calls for further investigation in this field.

More than two-thirds of the admitted patients who presented to the hospital with respiratory complaints and subsequently underwent chest CT scans were males. This significant epidemiological data aligns with the fact that respiratory illnesses are more common in males, as observed in other studies as well [10-12]. Out of the total 74 reviewed scans, only four were normal, shedding light on the appropriateness of using a costly radiological investigation like a CT scan, particularly in the rural vicinity of the hospital set-up. It also highlights the experience and expertise of the doctors, as almost negligible undue CT scans were ordered for patient management. This, in turn, reduces the misuse of healthcare resources and potential harm to the patients.

Limitation(s)

The study was conducted in a hospital situated in a rural set-up, which limited the number of patients visiting and getting admitted. Full efforts were made to study and analyse the CT scan reports and doctors' notes to gather information for the study. However, some degree of misjudgement could be expected due to the retrospective nature of the study.

CONCLUSION(S)

The utility of this radiological modality in patients with respiratory conditions not only helped confirm the diagnosis suspected by clinicians but also managed to detect certain unexpected pathologies, some of which required immediate intervention. This demonstrates the clinical utility of the modality to be fairly good. Additionally, it significantly influenced the patient's treatment by either leading to major additions or alterations in the treatment plan or by confirming the initial diagnosis made by the physician, thereby maintaining the same treatment plan with minor adjustments based on the CT scan results.

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